

## Technical Bulletin

### Insulspan SIP System CCMC Evaluation Report 13016-R

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REPLACES:	December 12, 2005

The Canadian Construction Materials Centre (CCMC) is a part of the National Research Council's Institute for Research in Construction. CCMC provides a national evaluation service for new and innovative materials, products, systems and services that is recognized by provincial and territorial building regulatory bodies.

Attached is CCMC **Evaluation Report** 13016-R for the Insulspan SIP System. The attached report has been revised as follows:

1. Insulspan Incorporated, Blissfield, MI plant has been added as additional listee.
2. Insulspan Corporation plant location has been updated to reference current address.
3. Evaluation confirms compliance with the National Building Code of Canada (NBC) 2005.

CCMC evaluation report 13016-R provides the following opinion under Section 2:

*Subject to the limitations and conditions stated in this report, test results and assessments provided by the proponent show that "Insulspan SIP System" complies with CCMC Technical Guide, Stressed Skin Panels (with structural ribs) for Walls and Roofs, MasterFormat 06122 dated Oct 10, 2004 and provides a level of performance equivalent to that required in:*

- NBC 2005, Sections 4.1 and 4.3 and Subsections 9.23.10., 9.23.13., 9.25.2., 9.25.3. and 9.25.4.

NBC 2005 sections referenced above relate to:

1. Section 4.1: **Structural Loads and Procedures**
    - **NBC 2005 Application:**  
CCMC evaluation addresses buildings to which Part 9 applies that are required to be designed to the requirements of Part 4
    - **NBC 2005 Intent Statement for Section 4.1:**  
To direct Code users to a Section of the Code containing detailed information on the application of Part 4.
  2. Section 4.3: **Design Requirements for Structural Materials.**  
CCMC evaluation validated the design methods used to prepare the Insulspan SIP System load span tables and connection details.
- Section 9.23: **Wood-Frame Construction.**  
The Subsections referenced relate to establishing equivalency to NBC requirements for wall stud spacing, framing (9.23.10.) and roofing and ceiling framing (9.23.13.).
  - Section 9.25: **Heat Transfer, Air Leakage and Condensation Control.**  
The Subsections referenced relate to establishing equivalency to NBC requirements thermal insulation (9.25.2), air barrier systems (9.25.3) and vapour barriers (9.25.4).

Refer to the attached report for additional detail.

**Note: Canada Mortgage and Housing Corporation requires a CCMC evaluation report for products used in construction financed or insured under the National Housing Act.**



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CCMC 13016-R

**CCMC**

EVALUATION  
REPORT

DIVISION 06122

Issued 2001-10-29

Re-evaluation 2007-03-08

Re-evaluation due 2007-10-29

# Insulspan Structural Insulated Panel (SIP) System

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## 1. Purpose of Evaluation

The proponent sought confirmation from the Canadian Construction Materials Centre (CCMC) that "Insulspan Structural Insulated Panel (SIP) System" can serve as exterior insulated loadbearing wall and roof panels as an alternative solution in compliance with the National Building Code of Canada (NBC) 2005.

## 2. Opinion

Subject to the limitations and conditions stated in this report, test results and assessments provided by the proponent show that "Insulspan SIP System" complies with CCMC's Technical Guide for Stressed Skin Panels (with lumber 1 200 mm o.c. and EPS core) for Walls and Roofs, MasterFormat number 06122, dated 06-12-05, and may serve as an alternative solution that will achieve at least the minimum level of performance required with respect to structural safety in:

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*NRC has evaluated the material, product, system or service described herein only for those characteristics stated herein. The information and opinions in this Report are directed to those who have the appropriate degree of experience to use and apply its contents.*

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- NBC 2005, Sections 4.1. and 4.3. and Subsections 9.23.10., 9.23.13., 9.25.2., 9.25.3. and 9.25.4.

Canada Mortgage and Housing Corporation permits the use of this product in construction financed or insured under the National Housing Act.

### **3. Description**

The “Insulspan SIP System” consists of structural framing with in-fill panels of expanded polystyrene (EPS) insulation glued to two oriented strandboard (OSB) panels. For wall panels in loadbearing applications, lumber studs are installed as structural ribs at 1.2 m o.c. at the panel joints. For roof panels, either lumber or I-joists are installed as structural ribs at 1.2 m o.c. at the panel joints. For nonstructural applications on post-and-beam construction, the panels have OSB splines for joining the panels.

The Type 1 and Type 2 EPS core insulation (see CCMC # 12424-L and # 12425-L) are certified by a third party and are also under a Plasti-Fab Ltd. upgraded quality assurance program that verifies the EPS’s mechanical properties.

The OSB panels conform to CAN/CSA-O325.0-92, “Construction Sheathing,” and are certified by a third party. In addition, the Insulspan Group requires that the OSB manufacturer provide assurance that its OSB panels possess the properties specified in Insulspan’s proprietary specifications entitled “Insulspan SIP Grade OSB.”

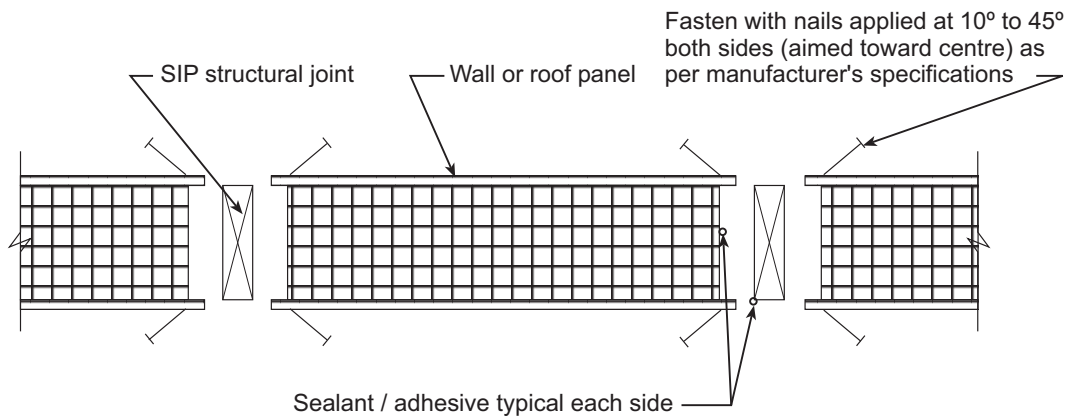
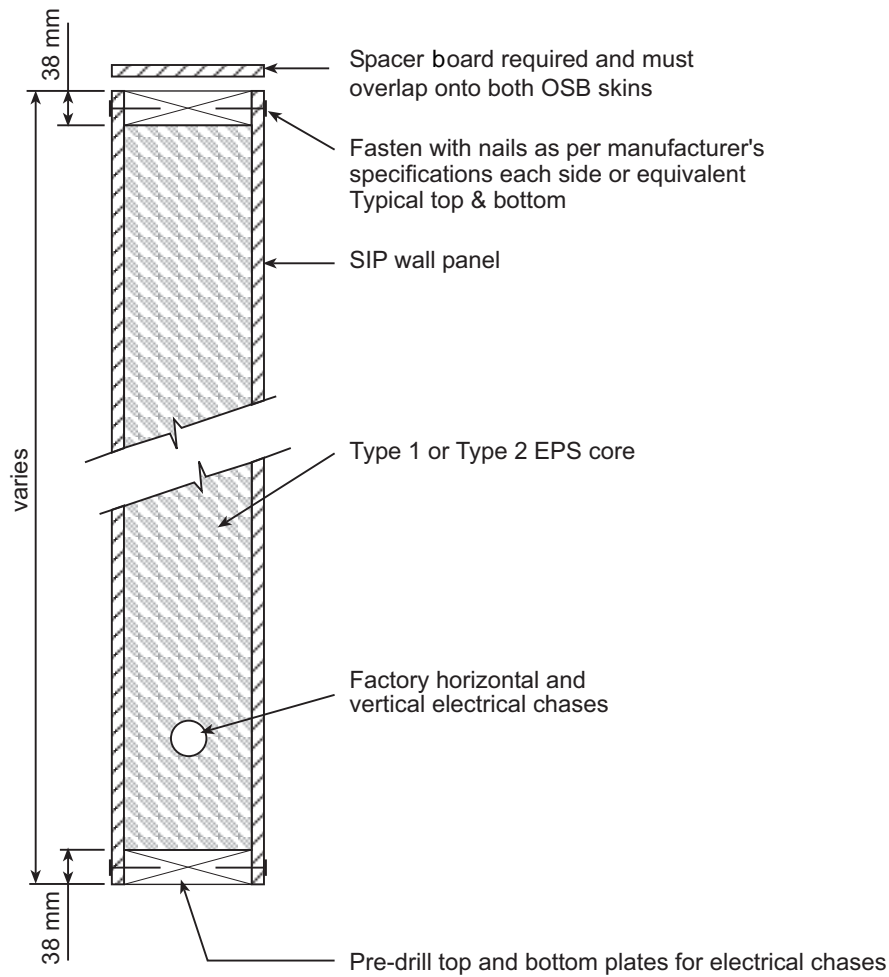
The adhesive used to bond the EPS core to the OSB facers is a moisture-cured, one-part urethane adhesive designed for application by bead applicator.

All aspects of the manufacturing of the “Insulspan SIP System” panel are verified by an in-plant quality control program. The plant quality control and the “Insulspan SIP System” panel are third-party certified by Intertek Testing Services (ITS) with the Warnock Hersey certification mark, providing assurance that panels meet the product proprietary specification.

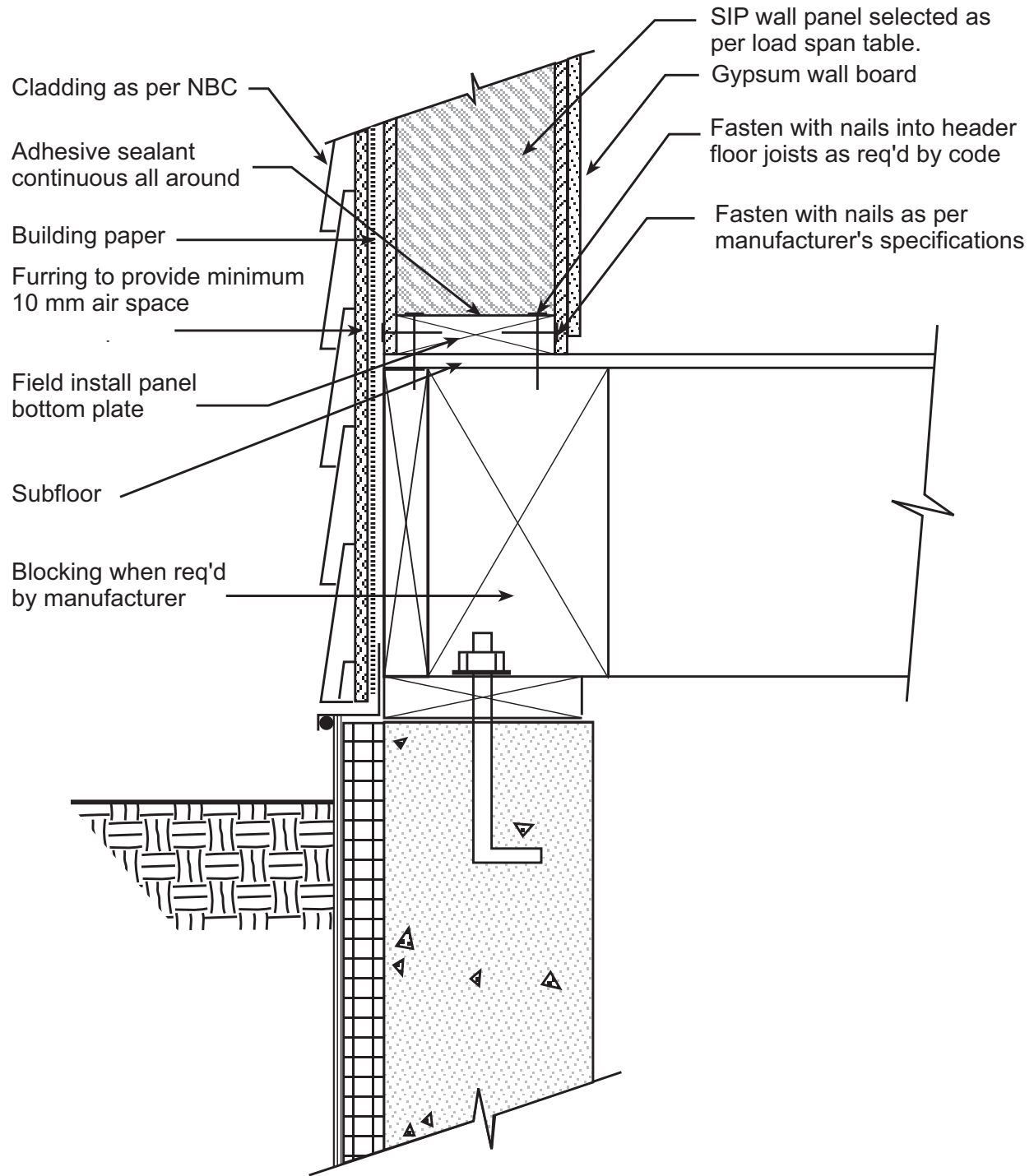
The panels are available in thicknesses of 115 mm, 165 mm and 210 mm for walls and 115 mm, 165 mm, 210 mm and 260 mm for roofs. The spans vary based on the anticipated loading and are outlined in the manufacturer’s published span charts as specified below.

Lintels for doors and windows are framed as in conventional framing. The “Insulspan SIP System” panel wall and roof construction is proprietary, with specific construction details for the top and bottom plates, the nailing schedule (number, spacing and angle of nail entry) and the field adhesive/sealant. The field construction sequencing must be in strict accordance with the Insulspan SIP Installation Guide (also Check List) and Site Reference Manual.

The figures below show the salient features of the “Insulspan SIP System.” Please refer to the manufacturer’s specifications for detailed requirements.



**Figure 1. "Insulspan SIP System" wall panels with lumber studs at 1.2 m o.c. See manufacturer's details for sealant and tape requirements.**



**Figure 2. "Insulspan SIP System" details of a wall panel connection to floors and rainscreen cladding. See manufacturer's details for sealant and tape requirements.**

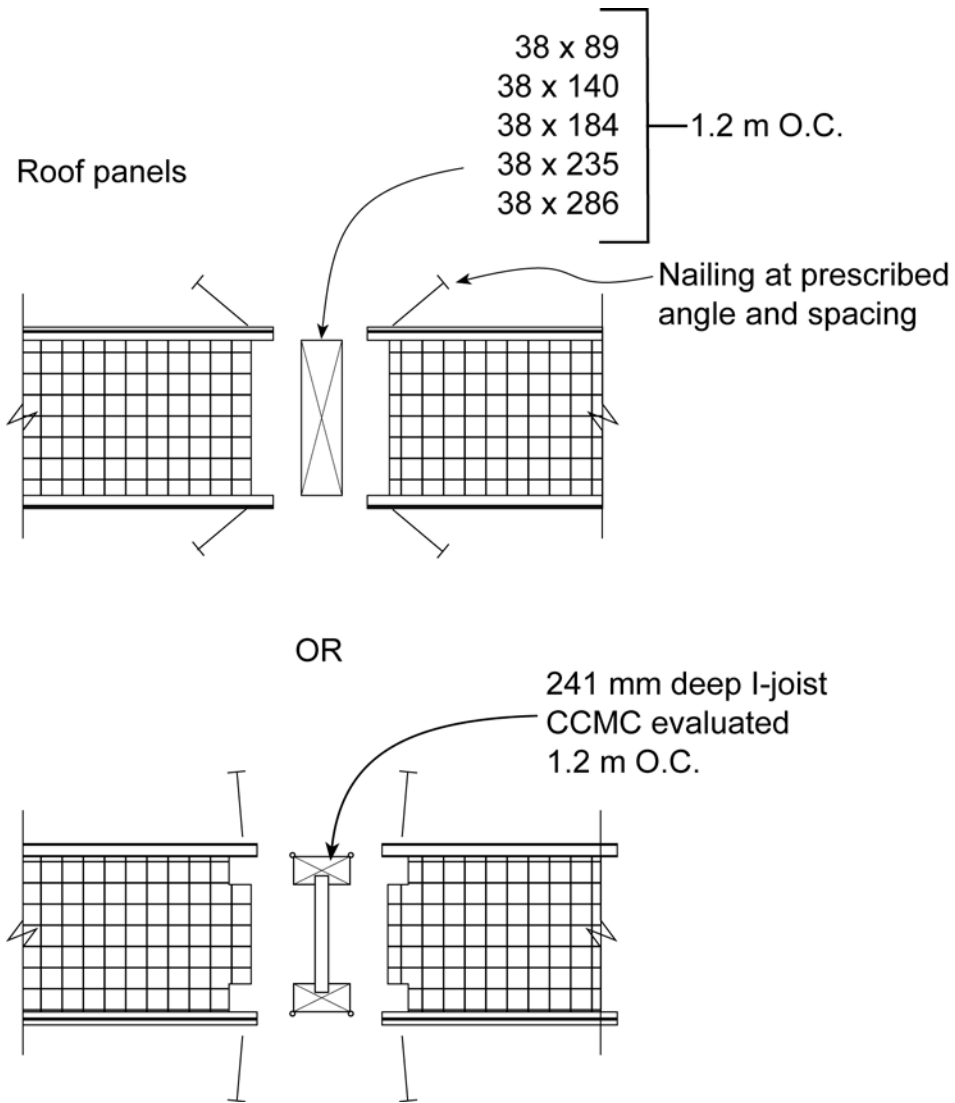
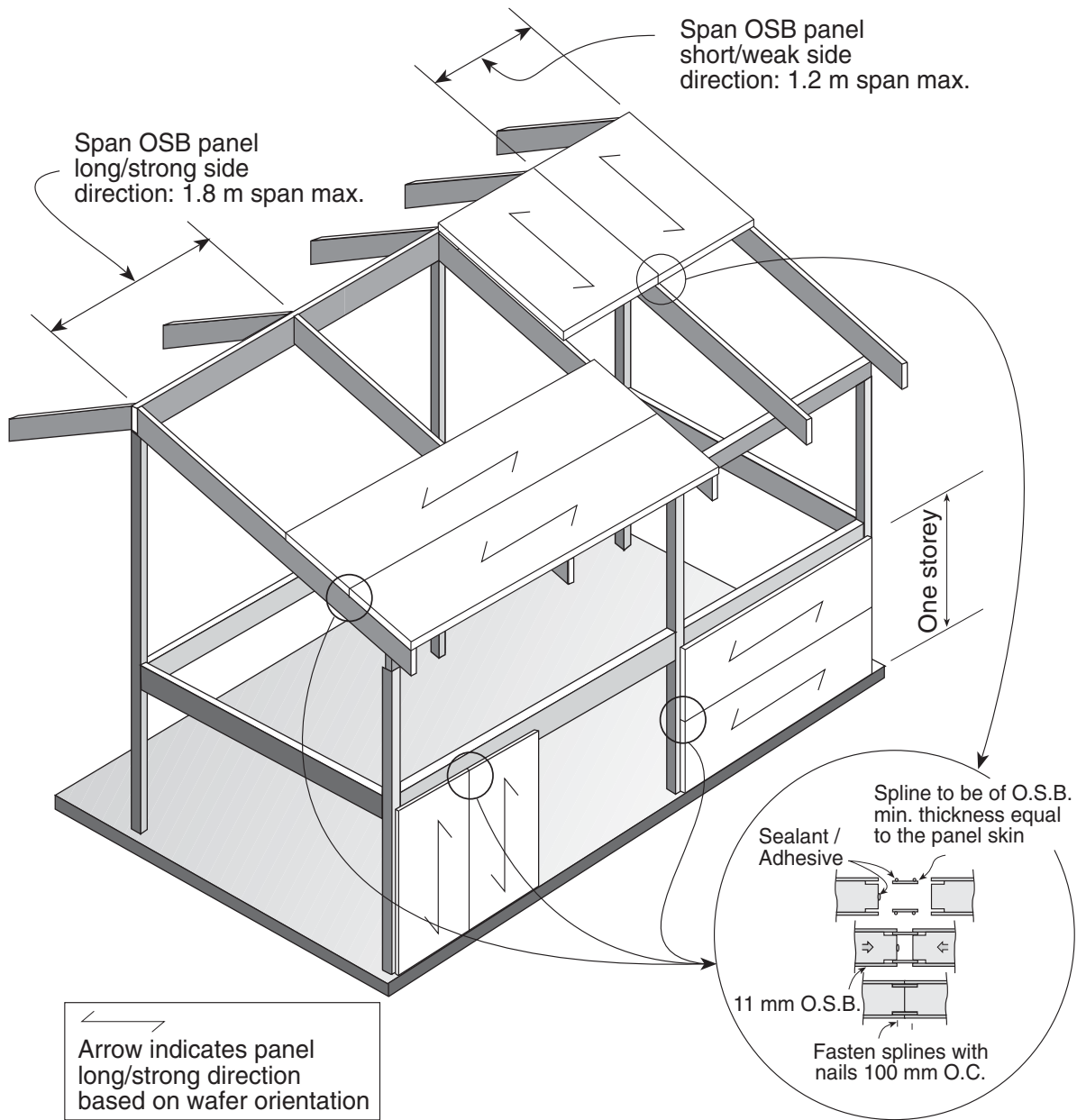
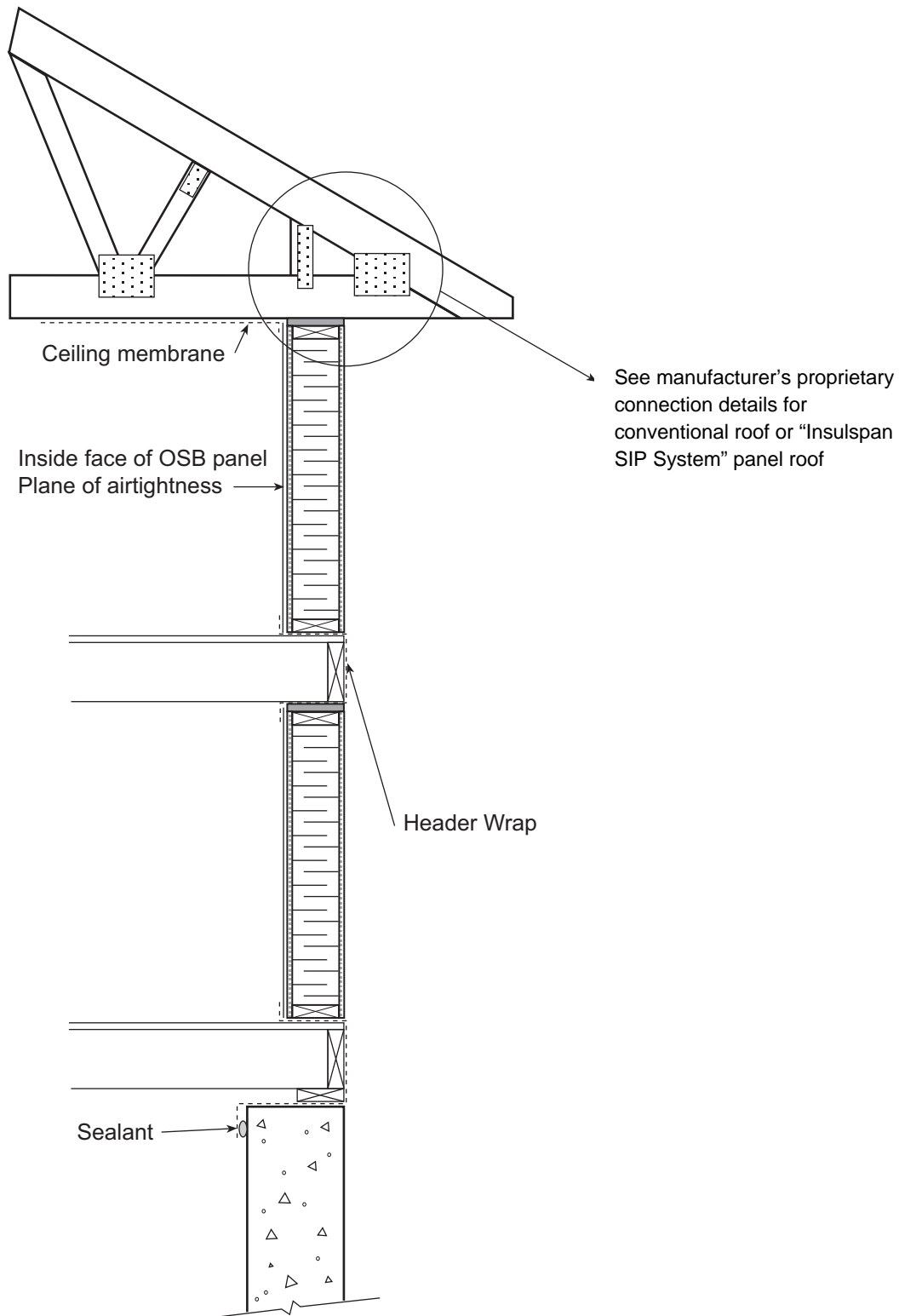


Figure 3. "Insulspan SIP System" structural roof panels with lumber or prefabricated I-joists at 1.2-m o.c. See manufacturer's details for sealant and tape requirements.



**Figure 4. "Insulspan SIP System" non-axially loaded structural panels with OSB splines on post-and-beam frame with limited roof spans of 1.2 m in OSB weak direction and 1.8 m in OSB strong direction. See manufacturer's panel-to-structure fastening details.**



**Figure 5. "Insulspan SIP System" proprietary air barrier system, continuity of seal of the inside barrier face to be maintained.**

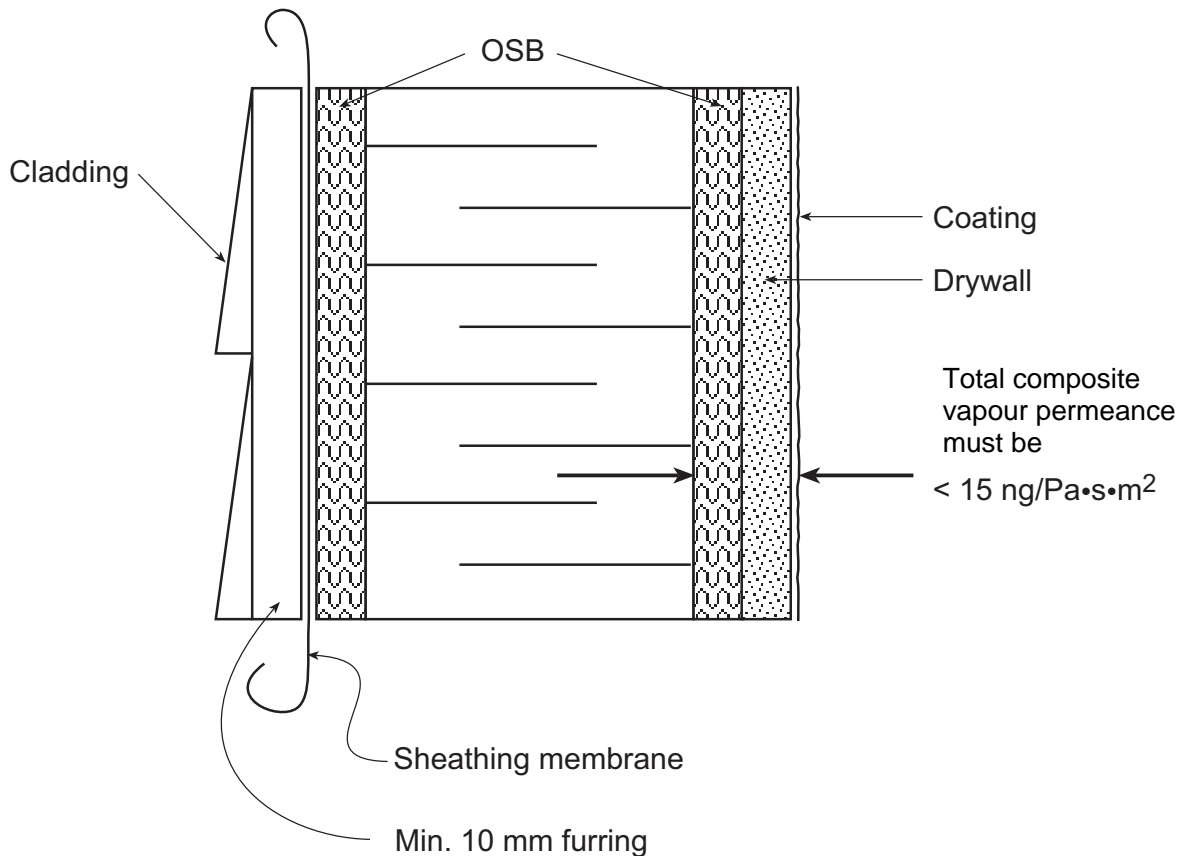


Figure 6. "Insulspan SIP System" vapour diffusion control.

#### 4. Usage and Limitations

The use of "Insulspan SIP System" as a structural insulating framing system is intended for single-family housing falling within the scope of the NBC 2005, Part 9. The "Insulspan SIP System" provides: (i) an alternative solution to Article 9.4.1.2. and Section 9.23. for framing of walls and roof, and (ii) is an NBC-specified acceptable solution meeting Section 9.25. for insulation, air leakage control and vapour diffusion control, when the following conditions and limitations are met:

##### For Structural Use

- When used as wall and roof panels, the installation must conform to the signed and sealed load tables for "Insulspan Structural Insulated Panels (SIP)," dated 06-08-10, for walls and for roofs.

These load tables have been prepared using a proprietary reliability-based SIP computer model with benchmark testing conducted to produce design values meeting the reliability targets of CAN/CSA-O86-01, "Engineering Design in Wood." As stated below, design details can be obtained from the manufacturer for custom designs not covered by the pre-engineered span tables.

It should be noted that the load tables outline the total specified live and dead loads permitted with a ratio of 2:1. As a result, the load tables are presented based on the anticipated local wind load and resulting maximum permitted axial load. The maximum total specified axial of live and dead loads of: 14.6 kN/m, 21.8 kN/m, 29.2 kN/m (1 000 lbs/ft, 1 500 lbs/ft or 2 000 lbs/ft) is permitted with a maximum dead load of 4.8 kN/m, 7.3 kN/m, 9.5 kN/m

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(333 lbs/ft, 500 lbs/ft and 667 lbs/ft) respectively. When this level of dead load is exceeded, the design must be modified to address duration of load effects.

For structural applications outside the scope of the above-referenced manufacturer's publications, the drawings or related documents shall bear the authorized seal of a professional engineer skilled in wood design and licensed to practice under the appropriate provincial or territorial legislation.

- Window and door lintel framing shall be conventional framing. Lintels at door and window openings shall be in conformance with Article 9.23.12.3. of the NBC 2005. Point loads within the wall assembly shall also be addressed in a conventional manner with adequate columns.
- Except for conventional treatment of lintels and point loads, the remainder of the SIP panel wall construction is proprietary with specific construction details for top and bottom plates, the nailing schedule (number, spacing and angle of nail entry), and field adhesive/sealant. The field construction sequencing must be in strict accordance with the Insulspan SIP Installation Guide (also Check List) and Site Reference Manual. The Insulspan Group provides field plans and field advisory service (when specified) for the proper installation of the panels.
- All details of design, handling, and installation shall comply with the manufacturer's current specification and instruction manual titled "Insulspan Structural Insulated Panel Installation Guide," dated 05-03-25. It is important that the construction sequence of the panel erection (i.e. bottom plate attachment to floor, panel erection, stud installation, top plate and second cover plate, nail spacing and angle of nail entry, adhesive, etc.) be followed to ensure panel performance.
- For areas of high wind and high seismicity, designers should consult the manufacturer for

proprietary shear wall test data for comparison with current Table of shear wall design values in CAN/CSA-O86. With no hold-downs, the "Insulspan SIP System" is limited for use in geographical locations where the  $q_{1/30}$  wind load  $\leq 0.6$  kPa and the zonal velocity ratio,  $v < 0.2$ .

#### *Air Leakage Control*

- The "Insulspan SIP System" panel can be used as an air barrier material within the manufacturer's proprietary air barrier system. Two layers of OSB and an EPS foam core meet the  $0.02$  l/s  $m^2$  at  $75$  Pa air leakage rate requirement and is equivalent to materials specified in Appendix Note A-9.25.3.2. of the NBC 2005. To be installed as the designated air barrier system, the panels must have joints sealed to maintain airtightness and continuity (i.e. header wrap around floors, sealed at penetrations, etc.) in accordance with Article 9.25.3.3. of the NBC 2005. See the manufacturer's proprietary air barrier system details.

Alternatively, if a separate proprietary air barrier system is to be installed, Insulspan Group recommends a sheathing membrane-type air barrier material and system as outlined in CCMC # 12857-R or # 12884-R.

#### *Vapour Diffusion Control*

- When used to provide vapour diffusion control, the "Insulspan SIP System" wall panels, consisting of two layers of OSB and EPS foam core, meet the requirements of Subsection 9.25.4. of the NBC 2005, when interior painted drywall with a composite water vapour permeance of  $15$  ng/Pa s  $m^2$  is installed on the warm side of the wall assembly and a 10-mm air space is installed on the cold side.

#### *Rain Penetration Control*

- "Insulspan SIP System's" performance depends on continuous protection from water penetration of the SIP panels for the projected lifetime of the structure. In conventional wood-frame structures, when a failure of the roof or wall cladding occurs, water would

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normally leak into the occupant's space. Such leakage alerts the occupants to failure and repairs can be undertaken.

In the case of closed panels, such as SIPs, the occupants may not be alerted of any water penetration until the exterior OSB skins have absorbed excessive moisture increasing the risk of failure. The use of OSB in wet conditions is not permitted as per CAN/CSA-O86 and the NBC 2005, hence the cladding design must prevent the OSB from being subjected to wet conditions.

As a result, both wall and roof cladding must be installed with a "second line of defence" against water penetration in line with the occupant expectations of performance and maintenance envisioned.

#### *Wall Cladding – Rainscreen System*

- The wall cladding shall be installed as a rainscreen system with a minimum 10-mm air space to allow for drainage of any water that may breach the cladding. The 10-mm air space for drainage shall be outboard of a sheathing membrane protecting the SIP panel. The membrane shall be properly installed in conjunction with top and bottom window flashing to shed water to the exterior.

#### *Roof Cladding – Design & Installation*

- The strength of conventional roof structures, whether they consist of roof trusses or roof rafters, is largely unaffected by the initial stages of any water penetration. In the case of SIPs, failure of the roof covering could lead to the rapid accumulation of moisture in the top skin accompanied by changes in the performance of the panels and, likely, permanent sagging of the roof panels.

Hence the design of the roof cladding for use with SIPs must perform to provide a reduced risk of water penetration when compared with conventional roof structures. The roof cladding installed shall have a second line of defence based on the anticipated wind-driven rain, snow and ice conditions for the geographical location.

Examples of a second line of defence include single or multiple layers of 15-lb or 30-lb asphalt-impregnated membranes or modified bituminous membranes. The selection should be based on the climatic loads at the building location, anticipated roof slope, quality of the roof cladding selected and occupant performance expectations and maintenance envisioned.

#### *Construction Moisture During Installation of Roof Panels*

- Care must be taken in the case where the "Insulspan SIP System" roof panels have been exposed to moisture/rain and where a water and vapour impermeable roof cladding is being installed (i.e. asphalt shingles). As the OSB panel, which has been wetted, cannot dry towards the attic (like in conventional construction), the exposed OSB panel should be allowed to dry before the asphalt shingles are installed. OSB, like other wood products, must be protected from excessive moisture and covered with cladding as soon as possible.
- These panels must be identified with the phrase "CCMC # 13016-R" along with the Intertek Testing Services (ITS), Warnock Hersey certification mark.

## **5. Performance**

Structural testing of the "Insulspan SIP System" was witnessed by an independent testing agency recognized by CCMC. The scope of the test program, quality control and certification programs are summarized below.

#### *Design Model*

Many of the structural panel tests and connection tests were used to calibrate and validate a reliability-based design computer model. The design model was then used for the engineering design of the panel for the various load configurations.

Structural test data for plant qualification to manufacture the "Insulspan SIP System" is

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consistent with test data used to validate the reliability-based design model. Insulspan plants are listed based on the accredited third-party plant qualification and the on-going quality control (QC) as part of the product certification.

#### *On-going QC and Certification*

All manufacturing plants listed in this report participate in third-party certification currently provided by Intertek Testing Services (ITS) as a third-party agency, a certification organization accredited by the Standards Council of Canada for this type of product. ITS has extended certification for the listed plant locations based upon:

- review of Insulspan's "Panel and SIP Engineering Model Program;"
- review of Panel qualification tests conducted by an independent testing agency recognized by CCMC; and
- implemented quality control procedures for staff, components, equipment and panel tolerances with panel testing at each of the listed plant locations. On-going audits of Insulspan manufacturing plants is conducted to verify continued compliance with all requirements.

#### *Stiffness*

Forty-nine (49) specimens of OSB panels, lumber ribs and wood I-joist ribs were tested for modulus of elasticity. In addition, testing of EPS to determine the shear modulus and density was conducted. Connection shear tests (90) to determine the shear stiffness of the rib-skin interface were also conducted.

#### *Full-scale Panel Strength Tests*

Thirty (30) full-size panels were tested and the results were compared with the predictions of the computer model. The model proved to be reliable in predicting the SIP panel performance for roof and wall panels.

*SIP Panel Tests – Weak (short) OSB Direction*  
Concentrated static and impact tests (wet and dry) were conducted on panels in accordance with CAN/CSA-O325.1. All specimens met the criteria

for 1.2-m span rating contained in CAN/CSA-O325.0.

*SIP Panel Tests – Strong (long) OSB Direction*  
Panel bending tests were conducted, before and after wetting, to determine the effect of moisture on the strength of the exposed panels. The loss of strength was in the order of 10% but remained well above the permitted specified ultimate transverse load.

#### *Creep and Recovery*

Three (3) pairs of full-scale panel bending tests were conducted with a sustained 24-hour specified load imposed. The CCMC criteria of a maximum 25% creep and recovery of L/1 440 were met. The permitted specified loads were then doubled and no failures occurred after 24 hours.

#### *OSB/EPS Adhesive Qualification*

Adhesive shear testing conducted to date, before and after aging, has demonstrated shear strength in excess of the EPS foam core.

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Manager, CCMC

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